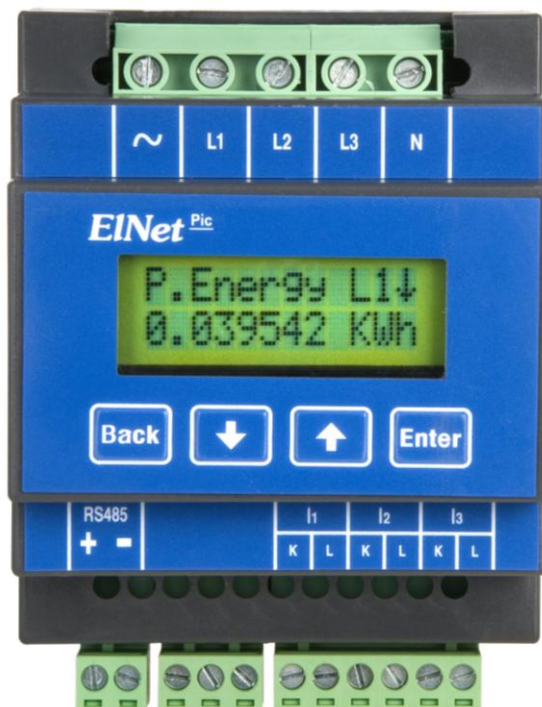




ELNet Pic 5/60

Energy Powermeter

Rev 1.4

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CHAPTER 1 — INTRODUCTION

1.1 About the *ELNet Pic* Powermeter

Large consumers of electricity e.g. factories, hotels, hospitals, municipalities, need to know the history of their consumption and the quality and the values of the power supply. Details such as Voltage, Current, Power Factor, Hertz, Neutral Current, Energy consumption can be displayed by the ***ELNet Pic*** Energy Powermeter.

An additional feature of the Multimeter is the ability to measure THD – Total Harmonic Distortion. Part of the Electricity Supply Authority's bill reflects poor or good Harmonics in the consumer's system, therefore it is in his interest to monitor Harmonics and try to improve it.

The ***ELNet Pic*** Energy Powermeter is a compact, multi functional, three-phase Powermeter simple to install and is especially designed to integrate into Building Management Systems. It requires no special mounting and is ideally suited for mounting on DIN rail of any standard electrical panel.

The Configuration and Setup is menu driven, with password protection.

Communication with external devices is simple and is based on standard known protocol.

Each ***ELNet Pic*** Energy Powermeter is carefully and meticulously manufactured using quality components and the latest production methods. Before leaving the factory each ***ELNet Pic*** Energy Powermeter is calibrated and is sent to the customer accompanied by the test certificate and Certificate of Compliance (C.O.C).

1.2 How to use this manual

We at CONTROL APPLICATIONS Ltd, envisage this manual to be used by three types of people, i.e. the ***Installation Technician***, the ***Senior Electrical Engineer*** and the end ***User***. For this reason this manual is divided into chapters for ease of reference by each of these different people. There could be a situation where two of the above mentioned tasks can be combined, or in a rare instance one person could handle all three tasks.

CHAPTER 1, *Introduction*, describes the ***ELNet Pic Powermeter***, its potential users, the readings it can provide and some of its features in brief.

CHAPTER 2, *Installation*, provides detailed instructions for unpacking, mechanical mounting, and electrical wiring up instructions for the ***Installation Technician***.

CHAPTER 3, *Using the ELNet Pic Powermeter*, describes in detail front Panel, the functions of the control buttons, and the Lock Utility.

CHAPTER 4, *Parameter Configuration & Settings* explains in detail the minimum parameters settings needed by the ***Senior Electrical Engineer*** to set up and configure the ***ELNet Pic Energy Powermeter***.

CHAPTER 5, *Front Panel Displays*, is an easy to follow step-by-step guide to obtain readings and tables.

CHAPTER 6, *Communications* provides details about the Communication capabilities of the **ELNet Pic** Energy Powermeter, and how to Set Up.

CHAPTER 7, *Specifications*, is a detailed list of specifications of the **ELNet Pic** Energy Powermeter.

1.3 Safety Information

The purpose of this manual is to help you. Please read the instructions carefully before performing any installation and note any precautions.

WARNING!

- Ensure that all incoming AC power and other power sources are turned off before performing any work on the **ELNet Pic** Energy Powermeter. Failure to do so may result in serious or even fatal injury and/or equipment damage.
- If the **ELNet Pic** Energy Powermeter is damaged in any way do NOT connect it to any power source.

- To prevent a potential fire or shock hazard, never expose the ***ELNet Pic*** Energy Powermeter to rain or moisture.
- Keep the surrounding area free of dirt and clutter especially metal objects. Good housekeeping pays.
- Inspect the cables periodically for cracks, kinks or any other signs of wear.
- Keep children away.
- Do not pull the cords.
- Users should stay alert and not approach the terminals of the ***ELNet Pic*** Energy Powermeter while tired or under the influence of alcohol, medicines or any other chemical substance that would tend to make a person drowsy.
- Above all use common sense at all times.

1.4 Warranty

CONTROL APPLICATIONS Ltd provides a 12- Month warranty against faulty workmanship or components from date of dispatch under the condition that the product was properly installed and used.

CONTROL APPLICATIONS Ltd does not accept liability for any damage that may be caused by natural disasters (such as floods, fire, earthquake, lightening etc.).

CONTROL APPLICATIONS Ltd does not accept liability for any damage that may be caused by malfunction of the ***ELNet Pic*** Energy Powermeter.

CONTROL APPLICATIONS Ltd will advise the customer on the proper installation and use of the **ELNet Pic Energy Powermeter**, but will not accept any responsibility that the instrument is suitable for the application for which it was originally purchased.

This warranty may become void if the Installation, Parameter Configuration & Setting Instructions are not carried out according to the instructions set out by CONTROL APPLICATIONS Ltd.

The **ELNet Pic Energy Powermeter** has no user serviceable parts and should be opened and serviced by a duly qualified authorized representative only. The sensitive electronics could become damaged if exposed to a static environment. This action would void the warranty.

This warranty is limited to the repair and/or replacement at CONTROL APPLICATION Ltd sole discretion of the defective product during the warranty period. Repaired or replaced products are warranted for ninety (90) days from the date of repair or replacement, or for the remainder of the original product's warranty period, whichever is longer.

CONTROL APPLICATIONS Ltd is always at your service to advise the customer on any problem that may be encountered regarding any installation, operation, parameter & configuration settings or maintenance.

1.5 Your comments are welcome

CONTROL APPLICATIONS Ltd. sincerely thanks you for choosing our ***ELNet Pic*** Energy Powermeter. We are confident that it will provide you with many years of trouble free service and give you all the power and energy information and history that you expected from the instrument when you bought it.

While every effort was made to keep the information as reliable, helpful, accurate and up to date as possible, all possible contingencies cannot be covered. Technical or typographical errors could occur, and we would be happy to receive any comments, criticisms or notifications of any such errors from you, our valued customer.

Address:	Control Applications ltd 24A HaBarzel St. Tel-Aviv 69710 Israel Tel: 972-3-647-4998 Fax: 972-3-647-4598
Electronic Address:	cal@ddc.co.il

1.6 Disclaimer

Information in this User Manual is subject to change without notice and does not represent a commitment on the part of CONTROL APPLICATIONS Ltd.

CONTROL APPLICATIONS Ltd supplies this User Manual as is without warranty of any kind; either expressed or implied, and reserves the right to make improvements and/or changes in the manual or the product at any time.

While it is the intention of CONTROL APPLICATIONS Ltd to supply the customer with accurate and reliable information in this User Manual, CONTROL APPLICATIONS Ltd assumes no responsibility for its use, or for any infringement of rights of the fourth parties which may result from its use.

This User Manual could contain technical or typographical errors and changes are periodically made to the information herein; these changes may be incorporated in new editions of the publication.

CHAPTER 2 — INSTALLATION

In this Chapter you will find the information and instructions that the **Installation Technician** needs to mount and connect the **ELNet Pic** Energy Powermeter.

WARNING!

- During operation, hazardous voltages are present in connecting cables and terminal blocks.
- Fully qualified personnel must do all work. Failure to follow this rule may result in serious or even fatal injury to personnel and/or damage to equipment.
- Refer to Section 1.3 Safety information before carrying out any installation.
- Read this manual thoroughly and make sure you understand the contents before connecting the **ELNet Pic** Energy Powermeter to any power source.

2.1 Contents of packaging

To unpack the *ELNet Pic* Energy Powermeter

The *ELNet Pic* Energy Powermeter is packed and shipped in a carton approximately 19x11x6.5 cm.

Before opening the package, ensure the area, clean and dry.

Without using any sharp instruments, carefully open the carton of the *ELNet Pic* Energy Powermeter.

Please check the contents of the carton, it should contain:

1. New *ELNet Pic* Energy Powermeter.
2. *ELNet Pic* wiring diagram.
3. Test Certificate and Certificate of Compliance. (C.O.C)
4. 3 Current Transformers. (*in case of Pic 60 only*)

2.2 Mechanical mounting

To Mount the *ELNet Pic* Energy Powermeter

NOTE!

Do not mount the *ELNet Pic* Energy Powermeter too close to any main electrical conductors

Allow sufficient space to carry out maintenance to the *ELNet Pic* Energy Powermeter

The *ELNet Pic* Energy Powermeter is manufactured with a standard DIN rail mounting. To mount, simply choose a suitable location and click into position.

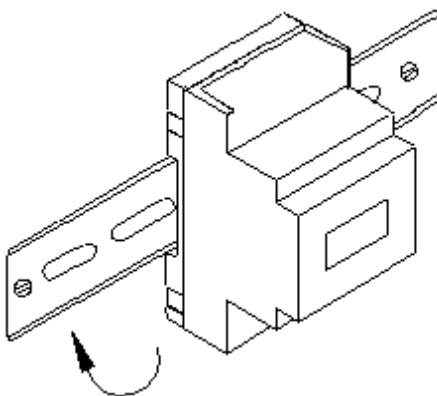


Figure 2.1 **Din Rail Mounting Diagram**

2.3 Wiring Schematics

To wire up the *ELNet Pic 5* Energy Powermeter

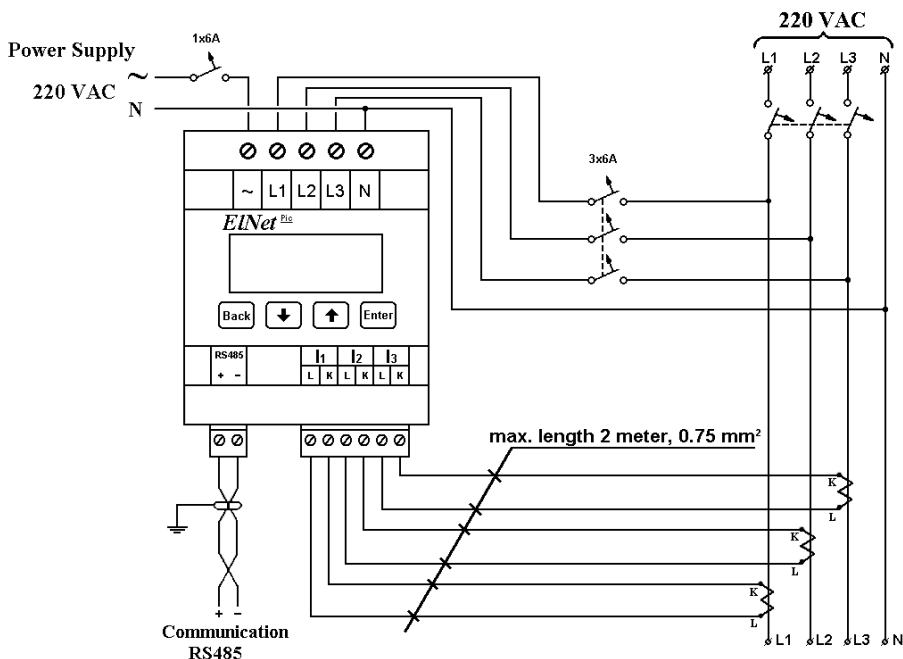


Figure 2.2 Schematic Wiring Diagram

To wire up the *ELNet Pic 60* Energy Powermeter

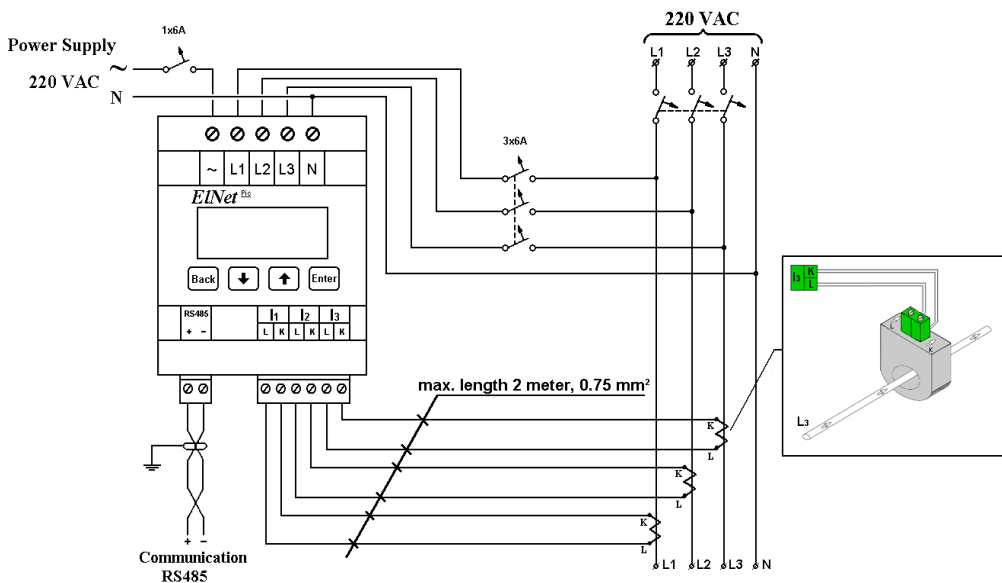


Figure 2.2 Schematic 60A Wiring Diagram

WARNING!

Do NOT ground the external current transformer.

2.4 Connections

To connect the *ELNet* Energy Powermeter

All Connections are made via terminal connector plugs (Voltage input, Power Supply, etc.).

Recommended max. tightening torque for the connector screws is 0.5 Nm.

The CT cores of the *ELNet* Energy Powermeter are located internally in the instrument and the lead from the leg of the external Current Transformer must be connected to the correct terminal connector in order to maintain the correct direction.

NOTE!

Ensure all the connections to the leads of the current transformer wiring is secure and there is no mechanical strain on the wire

Connect the lead from side “**L**” to the terminal connector L at the relevant phase, then connect the lead from side “**K**” to the terminal connector K at the same phase, of the *ELNet* Energy Powermeter.

WARNING!

Never allow an open circuit between the two Current Transformer leads.

Repeat the procedure for **Line 2** and **Line 3**.

Connect the rest of the connections to the **ELNet Pic Energy Powermeter** by means of terminal connector plugs.

The Front Panel (See Figure 2.3) has all connections printed and is simple to follow. (See table 2.1 for connections).



Figure 2.4 **Front Panel**

Pin Designation	Description	Remarks
L1	Line1 Supplied Voltage	Through a 6Amp fuse
L2	Line2 Supplied Voltage	Through a 6Amp fuse
L3	Line3 Supplied Voltage	Through a 6Amp fuse
N	Neutral	Measurement neutral Line
I1L	From Current Transformer L on Line1	Note the correct direction to insert the lead
I1K	From Current Transformer K on Line1	Note the correct direction to insert the lead
I2L	From Current Transformer L on Line2	Note the correct direction to insert the lead
I2K	From Current Transformer K on Line2	Note the correct direction to insert the lead
I3L	From Current Transformer L on Line3	Note the correct direction to insert the lead
I3K	From Current Transformer K on Line3	Note the correct direction to insert the lead
RS485 -	RS485 Comm. (-) Line	
RS485 +	RS485 Comm. (+) Line	

Table 2.1 Front Panel connections

2.5 Manufacturing Data.

2.5.1 From the main menu, use the ↓ ↑ buttons to scroll to **Config** menu and press “Enter”.



2.5.2 In the "PassWord..." menu use the ↓ ↑ buttons to change the password to 1 and press “Enter”.

2.5.3 The Configuration menu will appear, use the ↓ ↑ buttons to scroll to **Information** menu and press “Enter”.

2.5.4 The manufacturing Data will appear, use ↓ ↑ buttons to scroll between the data, when finished press “Back”.

Number	Screen	Description
1	EDt	Production date of software operating system
2	Ver	Bios Revision
3	ID	Unique identifying number

Table 2.2 **Production Data**

CHAPTER 3 — USING *ELNet Pic* Powermeter

In this chapter you will find descriptions and functions of the front panel and the control buttons and how to use them.

3.1 Front Panel

To operate the front panel:

The Front Panel has a graphic screen and 3 operating buttons.

The Control Buttons and their functions are fully explained in Section 3.2.

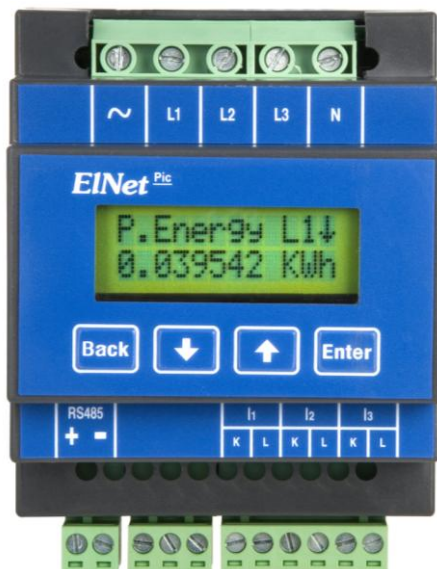


Figure 3.1 **Front Panel**

3.2 Control Buttons

To operate the Control Buttons on Front Panel:

The **ELNet Pic** Energy Powermeter has Four Control Buttons. With these buttons the **User** and **Senior Electrical Engineer** can achieve all the functions necessary.

The Control Buttons are arranged on a keypad below the display screen and require slight finger pressure to click.



Button “Enter” moves to the next level down (the one the arrow  is pointing to) OR selects a field to be set or changed (during Set UP).

Buttons   performs the scroll function (e.g. move the cursor), or selects the prompt that the arrow is pointing to.

The “Back” Button returns to the previous step or to the Main Menu.

CHAPTER 4 - NECESSARY *ELNet Pic* SETTINGS

In this chapter you will find instructions to set the minimum settings that are necessary to allow the ***ELNet Pic*** Energy Powermeter to function properly.

WARNING!

- The selection, installation and settings of the Current Transformer are the most vital and fundamental actions required to ensure the accuracy of the ***ELNet Pic*** Energy Powermeter.
- It is essential to know the ratio of the Current Transformer being installed into the system in order to set the parameter for the Current Transformer correctly.
- All three main current Lines **MUST** have Current Transformers of the same ratio installed onto them.

NOTE!

The most important setting necessary for the proper functioning of the **ELNet Pic** Energy Powermeter is the Current Transformer setting.

The cross section of the leads to the current Transformer must be compatible to the power of the current transformer. We recommend a power transformer with at least 3VA and the length of the wiring of the transformer no longer than 3m.

4.1 Settings for Current Transformer

- 4.1.1 From the main menu, scroll to **Config** menu and press "Enter".
- 4.1.2 In the "**PassWord...**" menu use the ↓ ↑ buttons to change the password to 1 and press "Enter".
- 4.1.3 The Configuration menu will appear, use the ↓ ↑ buttons to scroll to **CT Config** menu and press "Enter".
- 4.1.4 The Current Transformer screen appears.

CT = 0005 -> 5
 To Set CT... ↩

- 4.1.5 Press "Enter", to allow access to setting of the CT and then use ↓ ↑ change to the desirable value. When finished press "Enter" to save the change.

4.2 Phase Order Check

NOTE!

To avoid any problems arising from incorrect Voltage Connections or accidental reversal of Current Transformer Connections, it is necessary to perform a Phase Order Check before continuing.

To perform Line Status Check (Connection Check) & Phase Order Check:

4.1.1 From the Main Menu roll to **Config** and press “Enter”.

Config	←
Energy	↓

4.1.2 Insert password (as explained in paragraph 2.5) and roll to **Line Status**.

Line Status	←
Set Time	↓

4.1.3 Press “Enter”.

4.1.4 The Line Status & Phase Order screen appears.

Volt Line 1:OK
 Volt line 2:OK ↓

4.1.5 Click buttons ↓ ↑ to Roll Volts Line1,2 & 3.

4.1.6 Click buttons ↓ ↑ to Roll Curr. Line1,2 & 3.

Message	Voltage	Current
OK	Voltage present on Lines	Current present in Lines <u>and</u> synchronized with Voltage Lines
OPP	Not Applicable	Wired in incorrect direction
NO	No Voltage	No current

Table 4.1 **Phase Order Check**

4.1.7 Click buttons ↓ ↑ to Roll Phase Order.

Curr.L3:---
 Phase Order:OK ↓

Message	Voltage
OK	Correct Phase Order of Voltage Connections
OPP	Incorrect Phase Order i.e. Line 2 does not follow Line 1 and/or Line 1 does not follow Line3

Table 4.2 **Phase Order Check**

4.3 Time Settings

To set Time:

- 4.3.1 See Section 4.1 for instructions to arrive at the Configuration Menu. From the Configuration Menu scroll to **Set Time** and click “Enter”.



- 4.3.2 The **Set Time** screen appears, to allow access to set time press “Enter”.
- 4.3.3 Press ↓ ↑ to change the hours when finished press “Enter”.
- 4.3.4 The access to change minutes will appear, change the minutes by using ↓ ↑, when finished press “Enter”.
- 4.3.5 The access to change seconds will appear, change the seconds by using ↓ ↑, when finished press “Enter”.

4.4 Date Settings

To set Date:

- 4.4.1 See Section 4.1 for instructions to arrive at the Configuration Menu. From the Configuration Menu scroll to **Set Date** and click “Enter”.



- 4.4.2 The **Set Date** screen appears, to allow access to set date press “Enter”.
- 4.4.3 Press ↓ ↑ to change the days when finished press “Enter”.
- 4.4.4 The access to change months will appear, change the months by using ↓ ↑, when finished press “Enter”.
- 4.4.5 The access to change years will appear, change the years by using ↓ ↑, when finished press “Enter”.

The Date Format is: DD/MM/YY
 Day/Month/Year

4.5 Filter Settings

All readings in the *ELNet* Energy Powermeter are read and displayed every second. In a “noisy” system these readings would show wild fluctuations. Fluctuations can be “smoothed” out by applying Time Average Filters.

Time Average Filters utilizes the “Sliding Window” method. A calculation is made of the sum of a preset number of readings, divided by the same number to gives a new continuously moving average. This new calculated reading appears as the new reading every second

Recommended factory setting = 3 seconds.

NOTE!

The Time Average Filter does not affect any internal calculations or accumulation of data.

To set Voltage, Current, Power or Frequency Filters:

All 4 Filter settings procedures are identical:

- 4.5.1 See Section 4.1 for instructions to arrive at the Configuration Menu.
- 4.5.2 Roll to **Filter** and press “Enter”.
- 4.5.3 Roll to either **Voltage, Current, Power, or Frequency** Filters to access one of them press “Enter”.
- 4.5.4 Press “Enter” to change the filter values, when finished press “Back”.

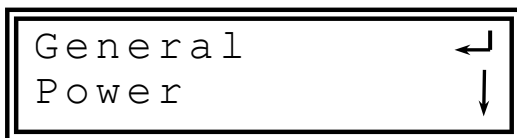
CHAPTER 5 — Text Panel Displays

In this chapter you will find instructions on how to obtain the readings that the *ELNet* Energy Powermeter provides, e.g., Current, Voltage Power, Power Factor and Energy.

5.1 Current

To display Current for all 3 Phases:

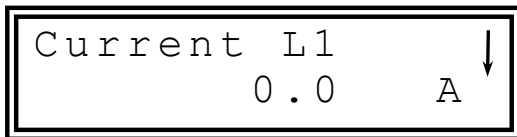
5.1.1 From the Main Menu roll to **General** and press “Enter”.



5.1.2 Roll to **Current** and press “Enter” .



5.1.3 The current screen will appear, use ↓ ↑ to roll to L2 and L3 when finished press “Back” to return to General Menu.



5.2 Current in Neutral Line

By using Vector calculations the *ELNet* Energy Powermeter calculates the Current in the Neutral Line.

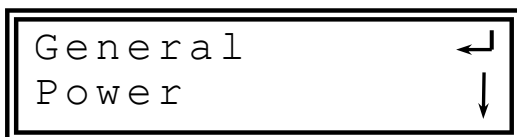
To display Current in Neutral Line:

Repeat Steps 1 to 3 as found in Section 5.1. Roll to Current In Neutral line.

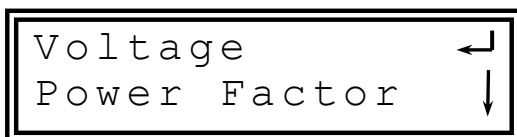
5.3 Voltage

To display Voltage for all 3 Phases and across Phases:

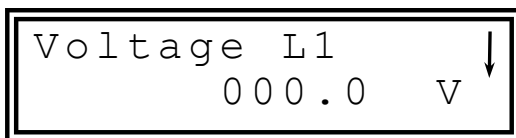
5.3.1 From the Main Menu roll to **General** and press “Enter”.



5.3.2 Roll to **Voltage** and press “Enter”.



The Voltage Screen Appears



5.3.3 Roll to Voltage Line 2, Line 3 and to Voltage between Line 1-2, Line 2-3 and Line 3-1.

5.3.4 When finished press “Back” to return to General Menu.

Parameter	Description	Units
L1	Voltage from Line1 to Neutral	Volts
L2	Voltage from Line2 to Neutral	Volts
L3	Voltage from Line3 to Neutral	Volts
L12	Voltage across Line1 and Line2	Volts
L23	Voltage across Line2 and Line3	Volts
L13	Voltage across Line1 and Line3	Volts

Table 5.1 **Voltage Screens Description**

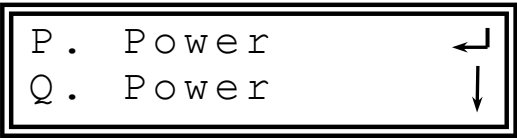
5.4 Active Power (P)

To display Active Power for all 3 phases:

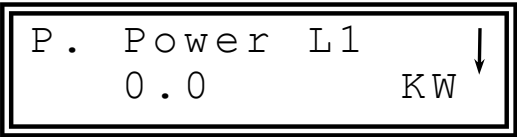
5.4.1 From the Main Menu roll to **Power** and press “Enter”.



5.4.2 Roll to **P. Power** and press “Enter”.



5.4.3 The Active Power Screen Appears.



5.4.4 Roll to Active Power Line 2, Line 3, ALL.

Parameter	Description	Unit
P	Active Power for each Line	Watts
Q	Reactive Power for each Line	VAR
S	Apparent Power for each Line	VA
Σ P	Total Active Power for all 3 Lines	Watts
Σ Q	Total Reactive Power for all 3 Lines	VAR
Σ S	Total Apparent Power for all 3 Lines	VA
PF	Power Factor	

Table 5.2 **Power Screens Description**

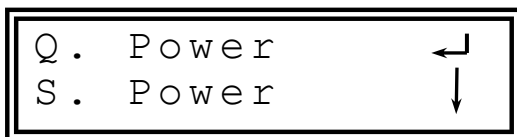
5.5 Reactive Power (Q)

To display Reactive Power for all 3 phases:

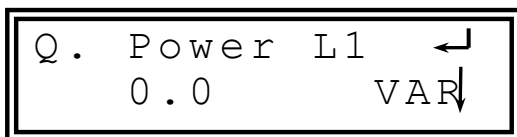
5.5.1 From the Main Menu roll to **Power** and press “Enter”.



5.5.2 Roll to **Q. Power** and press “Enter”.



5.5.3 The Reactive Power Screen Appears.



5.5.4 Roll to Active Power Line 2, Line 3, ALL.

5.6 Apparent Power (S)

To display Apparent Power for all 3 phases:

5.6.1 From the Main Menu roll to **Power** and press “Enter”.



5.6.2 Roll to **S. Power** and press “Enter”.



5.6.3 The Apparent Power Screen Appears



5.6.4 Roll to Apparent Power Line 2, Line 3, ALL.

5.7 Total Power Factor and for each Phase

To display Power Factor for all 3 phases:

5.7.1 From the Main Menu roll to **General** and press “Enter”.

5.7.2 Roll to **Pwr Factor** and press “Enter”.



5.7.3 The Power Factor Screen Appears.



5.7.4 Roll to Power Factor Line 2, Line 3, ALL.

5.8 Frequency

To display Frequency for all 3 phases:

5.8.1 From the Main Menu roll to **General** and press “Enter”.

5.8.2 Roll to **Frequency** and press “Enter”.



5.8.3 The Frequency Screen Appears.

F r e q .	L 1	↓
5 0 . 0	H r z	

5.8.4 Roll to Frequency line1, Line 2, Line 3.

5.9 Active Energy

To display Active Energy for all 3 phases:

5.9.1 From the Main Menu roll to **Energy** and press “Enter”.

5.9.2 Roll to **P Energy** and press “Enter”.

P E n e r g y	←
Q E n e r g y	↓

5.9.3 The Active Energy Screen Appears.

P . E n e r g y	L 1	↓
0 . 0 0 0	K W h	

5.9.4 Roll to Active Energy Line 1, Line 2, Line 3, ALL.

The Export Energy (opp. Direction) can be read via communicatoin. (Please check the ELNet Comm file).

5.10 Reactive Energy

To display Reactive Energy for all 3 phases:

5.10.1 From the Main Menu roll to **Energy** and press “Enter”.

5.10.2 Roll to **Reactive Energy** and press “Enter”.

Q Energy	←
S Energy	↓

5.10.3 The Reactive Energy Screen Appears.

Q. Energy L1	↓
0.000 KVRh	

5.10.4 Roll to Reactive Energy Line 2, Line 3, ALL.

5.11 Apparent Energy

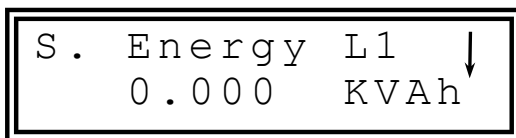
To display Apparent Energy for all 3 phases:

5.11.1 From the Main Menu roll to **Energy** and press “Enter”.

5.11.2 Roll to **Apparent Energy** and press “Enter”.

S Energy	←
TOU (Rates)	↓

5.11.3 The Apparent Energy Screen Appears.



5.11.4 Roll to Apparent Energy Line 2, Line 3, ALL.

Parameter	Description	Unit
P	Active Energy for each Line	KWh
Q	Reactive Energy for each Line	KVARh
S	Apparent Energy for each Line	KVAh
ΣP	Total Active Energy for all 3 Lines	KWh
ΣQ	Total Reactive Energy for all 3 Lines	KVARh
ΣS	Total Apparent Energy for all 3 Lines	KVAh

Table 5.3 Energy Screens Description

5.12 T.O.U Energy

The **ELNet Pic** Energy Powermeter record all energy values according to the T.O.U (time of use) schedule.

Each country has different T.O.U (time of use) schedule

To select the T.O.U schedule:

5.12.1 See Section 4.1 for instructions to arrive at the Configuration Menu.

5.12.2 Scroll to **T.O.U** and press “Enter”.

```
T . O . U .      ↵
Set  Time        ↓
```

5.12.3 The Select TOU rates screen appears.

```
TOU=Mexico      ↵
Prs ← To Set    ↓
```

5.12.4 Use the “Enter” to Select the T.O.U (time of use) schedule.

To check the Active Energy readings according to the TOU rates:

5.12.5 From the Main Menu roll to **Energy** and press “Enter”.

5.12.6 Scroll to **TOU (L1-3)** and press “Enter”.

```
TOU ( L1 - 3 )  ↵
TOU ( TOTAL )   ↓
```

5.12.7 Roll to **Rt-P.Energy** and press “Enter”.

Rt-P.Energy	↩
Rt-Q.Energy	↓

5.12.8 Roll to Rate 1 and press ↩.

Rate 1	↩
Rate 2	↓

5.12.9 The Active Energy Rate 1 screen appears.

Rt1 P.E	L1	↓
0.000000	KWh	

5.12.10 Roll to Active Energy Rate 1 Line 2, Line 3, ALL.

5.12.11 Repeat steps as described at 5.12.8 -5.12.10 for Rates 2,3.

5.12.12 Repeat steps as described at 5.12.5 -5.12.11 for

5.12.13 Reactive & Apparent Energy TOU Rates.

Rt-Q.Energy	↩
Rt-S.Energy	↓

CHAPTER 6 — COMMUNICATION

MODBUS Protocol

The **ELNet Pic** Energy Powermeter has a serial interface port allowing direct interface with an external communication network supporting the MODBUS Protocol.

MODBUS is an Industry Standard, widely known and commonly used communications protocol. Using MODBUS provides communication between a PC and up to 247 Powermeter slaves on a common line - the PC being the **master** and the powermeters the **slaves**. The PC initiates the transaction (either a query or broadcast) and the Powermeter/s responds. Powermeters respond to the **master** PC's request, but will not initiate any transmission on its own. The PC sends a single Query transaction and the Powermeter responds in a single response frame and is capable of only one query and one response at a time.

6.1 MODBUS Framing

6.1.1 RTU Transmission Mode

MODBUS uses the standard Remote Terminal Unit (RTU) transmission mode. RTU mode sends data in 8-bit binary EVEN parity or 8-bit binary NO parity data format. For the **ELNet Pic** Energy Powermeter to successfully communicate, choose one in the communication Set Up.

Field	No. of bits
Start bit	1
Data bits	8
Parity	1
Stop it	1

Table 6.1 RTU Data Format

6.1.2 The RTU Frame Format

Query and response information is sent in frames. Each frame contains:

Address

Function (See Section 6.1.4 for descriptions of functions),

Data

Check

Address	Function	Data	Check
8 bits	8 bits	N * 8 bits	16 bits

Table 6.2 R T U Message Frame Format

If the receiving device (Powermeter) detects a time laps of five characters, then it will assume the message is incomplete and will flush the frame. The device then assumes that the next byte received will be an address. The maximum query and response message length is 256 bytes including check characters.

6.1.3 Address Field

Each Powermeter is designated in a network system by a user assigned address. The Address can be any number between 1 and 247. The Powermeter will only respond to its own specifically assigned address.

6.1.4 Function Field

The function field contains the code that tells the Powermeter what action to perform.

The *ELNet Pic* Energy Powermeter uses and responds to four standard Message Format Functions.

Function 03

Function 04

Function 06

Function 16

Function	Meaning in MODBUS	Action
Function 03	Read holding register	Obtain data from Powermeter (Read register)
Function 04	Read input register	Obtain data from Powermeter (Read register)
Function 06	Preset single register	Transmit data to Powermeter (Write single register)
Function 16	Preset multiple register	Transmit data to Powermeter (Write multiple register)

Table 6.3 **Function Codes**

6.1.5 Data Field

The Data field contains the body of the message and contains instructions from the PC **master** to the Powermeter **slave** to perform a particular action or respond to a query. The reply message from the Powermeter will be information contained in one or more of its registers.

6.1.6 Check Field

The error check field contains the result of Cyclical Redundancy Check (CRC). The start of the message is ignored in calculating the CRC.

For more detailed information on CRC, refer to the MODBUS Protocol Reference Guide.

6.2 Registers for *ELNet Pic* Multimeter

The ***ELNet Pic*** Energy Powermeter is capable of supporting either Function 03 or Function 04 Message Format (see Table 6-3). In a reply to a query from the PC **master** for a reading from a particular field, the response from the Powermeter can be either in Format 03 or Format 04 but will depend on which Format the query was originally sent.

The difference is significant because by using Function 03 the *ELNet Pic* will only send the INTERGER part of the field value requested and the PC **master** will only display the INTERGER part of the field value.

Function 04, on the other hand, is capable of sending two separate halves of the full FLOAT requested information (each half contained in a separate register). Then it is the task of the PC **master** to merge the two halves into a full FLOAT reply (For more detailed information See IEEE Standard 754 Floating-Point).

E.G. 1 If the user's PC **master** supports Function 03, then the reply will contain the INTERGER part of the field only.

The PC **master** requests the Voltage from Line1, and the actual Voltage in that field is 230.5 Volts.

Function 03 will respond with the INTERGER only i.e. 230V.

E.G. 2 If the user PC **master** supports Function 04, then the reply will contain the information stored in the two registers assigned to that field and will contain the full, accurate reply.

The PC master requests the Voltage from Line1, and the actual Voltage in that field is 230.5 Volts.

Function 04 will respond with a composite reply of both register 1 and 2 giving the full FLOAT value (in IEEE Format) from that field i.e. 230.5V.

6.2.1 Registers addresses

The **ELNet Pic** MODBUS registers addresses are updated all the time and can be downloaded from the following web site:

http://www.ddc.co.il/elnet-pdf/elnet_comm.pdf

The MODBUS registers addresses numbering order specify at the above mentioned web address set as a defaults but can be changed in order to be fit to the SCADA/HMI drivers.

6.3 Communication Connections

The ELNet Pic Energy Powermeter supports RS485 communication. Connections are provided on the bottom front terminal of the device. (Please refer to section 2.4) and are made by means of the connectors provided.

6.4 Communication Settings

To enable the **User** to connect the **ELNet Pic** Energy Powermeter to a PC computer for successful communications, the Communication Setup parameters of both must match; i.e. the port of the PC and the configuration settings of the Power meter.

Address
Baud Rate
Parity

6.4.1 Communication Address

Each Power meter in a communication system must have its own unique address.

Because the *ELNet Pic* Energy Powermeter works on MODBUS, the available addresses are - from '1' to '247'.

6.4.2 Baud Rate

The Baud Rate is the communication speed in Bits per second (BPS) that the *ELNet Pic* Energy Powermeter communicates with the PC. The better the communication line Quality, the faster the communications may be.

If the communication line is routed through a “noisy” environment, it may be necessary to decrease the Baud Rate.

Available Baud Rates for the *ELNet Pic* Powermeter:

300	bps
600	bps
1200	bps
2400	bps
4800	bps
9600	bps
19200	bps
38400	bps

6.4.3 Parity

The choices of parity are either NONE or EVEN (see Section 6.1.1 for description of Parity).

6.5 Communication Set Up

6.5.1 Address Set Up.

To set up Address:

1. See Section 4.1 for instructions to arrive at the Configuration Menu.
2. Roll to **Communicat.** and press "Enter".
3. The communication screen will appear.

Address	←
Baud	↓

4. Roll to **Address** and press "Enter".
5. The Address screen will appear.

Address = 31	↓
Prs ← To Set	

6. Pressing "Enter" will change the address, when finished press "Back".

6.5.2 Baud Rate Set Up.

To set up Baud Rate:

1. See Section 4.1 for instructions to arrive at the Configuration Menu.
2. Roll to **Communicat.** and press “Enter”.
3. The communication screen will appear.

Baud	←
Parity	↓

4. Roll to **Baud** and press “Enter”.
5. The Baud Rate screen will appear.

Baud = 4800	↓
Prs ← To Set	

6. Pressing “Enter” will change the Baud Rate, when finished press “Back”.

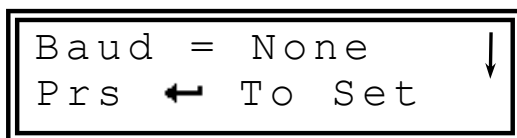
6.5.3 Parity Set Up.

To set up Parity:

1. See Section 4.1 for instructions to arrive at the Configuration Menu.
2. Roll to **Communication** and press “Enter”.
3. The communication screen will appear.



4. Roll to **Parity** and press “Enter”.
5. The Parity screen will appear.



6. Pressing “Enter” will change the Parity, when finished press “Back”.

6.5.4 Stop Bit Set Up.

To set up Parity:

1. See Section 4.1 for instructions to arrive at the Configuration Menu .

2. Roll to **Communication** and press “Enter”.

3. The communication screen will appear.

Stop Bit Address	← ↓
---------------------	--------

4. Roll to **Stop Bit** and press “Enter”.

5. The Stop Bit screen will appear.

Stop Bit = 0 Prs ← To Set	↓
------------------------------	---

6. Pressing “Enter” will change the Stop Bit, when finished press “Back”.

NOTE!

When the selection is made it takes immediate affect with no further action required.

6.6 Communication with UniArt Software

CONTROL APPLICATIONS Ltd propriety software, “UniArt” is used to **Read** and **Write** Registers of the **ELNet Pic Energy Powermeter**. Each Item number in the Registers Table is a unique field containing information. The UniArt software manages each Item number as a parameter. Refer to the UniArt manual how to set up parameters.

To read fields using UniArt:

1. Find the reading required in the MODBUS Registers Table.
2. Note the Item Number from the Registers Table.
3. Go to the correct File number.

Since File capacity in UniArt is limited to 128 parameters, the information contained in the ELNet Pic fields is stored in several files.

File number is determined by the Item number

File # 0 contains	Item number	1 - 128
File # 1 contains	Item number	129 – 256
File # 2 contains	Item number	257 – 384
File # 3 contains	Item number	385 – 512

4. Go to the correct Point number within that file Point number is determined by the formula:

$$\text{Item number} - [\text{FILE} \times 128] = \text{Point Number}$$

E.G. 1 If the user wishes to read Voltage Line 2 (Item No 2)

By applying the formula: $2 - [0 \times 128] = 2$

File = 0 and Point within that file = 2

E.G. 2 If the user wishes to read 30th Harmonics for Volts Line1 (Item No 330)

By applying the formula: $330 - [2 \times 128] = 74$

File = 2 and Point within that file = 74

E.G. 3 If the user wishes to read 7th Harmonic for Current Line 3 (Item No 467)

By applying the formula: $467 - [3 \times 128] = 83$

File = 3 and Point number within that file = 83

More Examples:

E.G. No	Item No	Field Description	File	Point
1	2	Voltage Line 2	0	2
2	330	30 th Harmonics for Volts Line1	2	74
3	467	7 th Harmonic for Current Line 3	3	83
4	128		0	128
5	129		1	1
6	256		1	128
7	257		2	1
8	384	20 th Harmonics for Volts Line 3	2	128
9	385	21 st Harmonics for Volts Line3	3	1

Table 6.4 Function Codes

CHAPTER 7 — Specifications

Item	Description
Power requirements	85-250V AC 50 Hz, 5VA
Dimensions	(HxWxD) 96x76x57 mm
Shipping Weight	450 gr.
Measuring voltage limits	650VAC
Measuring current limits	6 A / 63 A
Operating Voltage limits	1000 V
Operating Current limits	50 A
Enclosure material	ABS + Anti flame
Display	Graphic 64x128
Operating temperature	-20 - + 70 C
Storage temperature	-20 - + 80 C
Humidity	0- 90 RH%
Voltage input terminals	VL – E10 1708
Communication port	RS485
Mounting	DIN Rail

Table 7.1 Specifications

All technical specifications are subject to change without notice